Color Dipole-Dipole Cross Section at High Energies and the Resulting Nuclear Structure Functions at small x_Bj

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Abstract

In order to study systematically heavy ion collisions at RHIC energies, one needs an understanding of the underlying elementary processes, such as the dipole-dipole interaction. These processes are governed by soft and hard QCD. A model which describes microscopically both the soft and hard part of the QCD interaction is the model of the stochastic vacuum (MSV) combined with perturbative two-gluon exchange. To constrain the elementary amplitude, we calculate several observables for hadronic processes and DIS in the framework of the MSV. In particular, we focus on the proton-proton, gamma-proton, and the more fundamental dipole-dipole interaction. The results are in good agreement with available experimental data. We are able to compare the well-known perturbative structure of the dipole-dipole cross section to the non-perturbative one, extracted from the MSV in momentum space. The linear rise of the dipole-proton cross section for large dipole sizes is generated by non-perturbative string-string interaction. This feature is in contrast to the saturation assumption of many phenomenological models. The dipole-proton cross section can be used to calculate several quantities relevant to heavy ion collisions. As an example, we determine integrated/unintegrated gluon distributions in nuclei.

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